REMARKS

Claims 1-27 were rejected. The specification is amended herein to correct minor informalities. In particular, the misspelled word "chosed" on page 7 should be --chosen--; "emission surface **48**" on pages 14-17 should be --emission surface **56**-- as shown in Figs. 1 and 2; and "target 44" on page 17 should be --target 46-- as shown in Figs. 1 and 2. Claims 1 and 7 are amended herein to more particularly pointing out and distinctively claiming subject matter of which the applicant regards as the invention. Support for the amendment can be found in the Specification, in particular, page 17, lines 19-34. No new matter is introduced. No claim is newly added or cancelled. Claims 1-27 are pending.

Regarding 35 U.S.C. § 102(b) rejections --

Claims 1-27 were rejected under 35 U.S.C. § 102(b) as being anticipated by Fox et al. (U.S. Pat. No. 5,592,053). The rejections are respectfully traversed and reconsideration is earnestly requested.

> "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Regarding claims 1 and 23, Fox et al. do not teach or anticipate **each and every element as set forth in these claims**, either expressly or inherently described. In particular, Fox et al. do not teach or anticipate, *inter alia*, a means for controlling an energy of the seed electrons such that the seed electrons generate electron-hole pairs in the target and A FRACTION OF THE ELECTRON-HOLE PAIRS SUPPLY THE EMISSION ELECTRONS; and where the target thickness and the energy of the seed electrons are optimized such that the emission electrons are SUBSTANTIALLY THERMALIZED AT THE EMISSION SURFACE. The Office action did not reasonably explain how Fox et al. teach or anticipate these claim

elements. Regarding claims 2-22 and 24-27, the Office action did not articulate how Fox et al. actually teach or anticipate each and every element as set forth in these claims. Indeed, the Examiner has not provided a basis in fact and/or technical reasoning to reasonably support the determination that the claimed characteristic necessarily flows from the teachings of the applied prior art. "In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." *Ex parte Levy,* 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original.)

Fox et al. do not teach or disclose an invention identical to that is contained in the claims of the present application. As specifically distinguished in the present application, although Fox et al. recognize that diamond can be used as a target in an electron beam device, the invention disclosed in Fox et al. unfortunately is NOT capable of satisfying the requirements of high brightness, narrow energy spread and robustness at the same time [Spec. page 3, lines 1-12, and page 4, lines 23-30]. Fox et al. specifically mention negative electron affinity as an option on the field emitter tip that illuminates the back side (the illumination surface) of the target [col. 9, lines 51-61]. Fox et al. do not, however, mention any surface modification to induce a negative electron affinity on the emission surface of the target. Without some barrier lowering, preferably enough for zero or negative, electron affinity on the emission surface, the low energy electrons cannot escape into the vacuum. Therefore, the device shown and described in Fox et al. cannot provide electron emission of fully thermalized electrons, as taught and claimed in the present application.

The electron beam device of Fox et al. shown in Figs. 1 and 2 are configured as an electron beam amplifier [col. 3, lines 30-31; col. 10, lines 25-27]. In this configuration, the device includes a resonant cavity or a radio frequency coil, i.e., modulator **48**, for modulating the constant electron beam **22** in response to an electrical signal supplied by signal generator **50** [col. 3, lines 32-41; col. 10, lines 14-31]. An amplified signal is then produced at output **46** [col. 10, lines 14-19]. Amplification is possible "because the electron beam **22** generates one electron-hole pair for every 16.5 eV of energy that is dissipated." [col. 10, lines 19-21]. Fox et al. do not teach or suggest a means for controlling an energy of the seed electrons such that

the seed electrons generate electron-hole pairs in the target and a fraction of the electron-hole pairs supply the emission electrons.

More importantly, Fox et al. do not teach or suggest that the target thickness and the energy of the seed electrons are optimized such that the emission electrons are SUBSTANTIALLY THERMALIZED AT THE EMISSION SURFACE. In Fox et al., the thickness of the diamond layer **24** is designed to be equal to the penetration depth of the electron beam into the diamond [col. 2, lines 55-56; col. 7, lines 57-59]. This is so that all of the electrons are absorbed by the diamond layer, providing a high electron-hole conversion efficiency [col. 2, lines 55-58; col. 7, lines 59-61]. As such, no space charge limited conduction is required to transport carriers across an *excess* thickness [col. 7, lines 62-63]. Contrastingly, as particularly taught in the present application, target thickness is optimized in coordination with the energy of seed electrons and taking into account the electron-hole recombination rate, such that, by the time a seed electron reaches the emission surface it is substantially thermalized but still has not had sufficient time to recombine [Spec. page 15, line 27, through page 16, line 5]. The more complete the thermalization of emission electrons at the emission surface, the smaller the energy spread of the emission electrons in the beam of emission electrons [Spec. page 8, lines 20-24]. Substantially thermalized electron, according to the teaching of the present application, exhibits an energy spread of about 0.026 eV at room-temperature and even less at lower temperatures [Spec. 16, lines 8-17], thereby enabling the claimed semiconductor source to provide emission electrons with high brightness and narrow energy spread.

Clearly, to allow emission electrons to be substantially thermalized at the emission surface, penetration of the target by the energy of the seed electrons should be prevented [Spec. page 17, lines 19-34]. Claim 1 is particularly amended herein to make the implicit explicit and thus should not be considered as necessitating a new search or ground for rejection.

Not only Fox et al. do not teach or anticipate the semiconductor source of emission electrons as claimed, Applicants further respectfully submit that, at the time of the invention, one skilled in the art would not have been motivated to modify Fox et al. and somehow arrived at

the invention as claimed. This is at least because Fox et al. teach away from the claimed invention by disclosing that the thickness of the diamond layer is preferably equal to a penetration depth of the electron beam so that the efficiency of generation of carriers with respect to electron beam current is increased [col. 2, lines 55-58].

Conclusion

For the foregoing reasons, it is respectfully submitted that the present invention is patentably distinct from, not anticipated by, and unobvious in view of Fox et al., the closest prior art of record. In particular, independent claims 1 and 23 respectively recites subject matter not reached by the closest prior art of record under 35 USC §§ 102(b) and/or 103(a), as discussed before. Accordingly, it is submitted that independent claims 1 and 23 are patentable and therefore should be allowed.

Reliance is placed on *In re* Fine, 5 USPQ 2d 1596, 1600 (Fed. Cir. 1988) and *Ex parte* Kochan, 131 USPQ 204 (Bd. App. 1960) for allowance of the dependent claims 2-22 and 24-27, since they differ in scopes from their respective parent independent claims 1 and 23 which are submitted as patentable.

This Response/Amendment is submitted to be complete and proper in that it places the application in a condition for allowance without adding new matters. Favorable consideration and a Notice of Allowance of all pending claims are therefore earnestly solicited. The examiner is invited to telephone the undersigned at 650-331-8413 for discussing an examiner's Amendment or any suggested actions for accelerating prosecution and moving the present application to allowance.

Respectfully submitted,

Katharina Schuster

Katharina Wang Schuster, Reg. No. 50,000
Attorney for the Applicants under 37 CFR 1.34

LUMEN INTELLECTUAL PROPERTY SERVICES
2345 Yale Street, Second Floor
Palo Alto, CA 94306
(O) 650-424-0100 (F) 650-424-0141